

# Introduction

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## Basic Information

- ***Soft Machine Vision***
- Smart Factory Innovation Club of Zhejiang University
- Class locations: 紫金港月牙楼301
- Class time: Sunday 9:30 to 11:30
- Number of students enrolled: 42

## Course Outline

- Image basics: Pixels, Colors, Image formats
- Image processing techniques: Filtering, Binarization, cutting, Morphological transformation, Scale and rotation transformation, Image gradient
- Image pattern recognition: Line and circle detection, Feature point detection, Edge detection
- Image pattern recognition: Blob detection, Feature point detection, Template matching
- Neural Network basics: Neuron structure, Multi-layer Perceptron, Handwritten digit recognition, Loss function
- Neural Network basics: Gradient Descent, Backpropagation
- Modern Neural Network: Softmax regression, Deep neural network, Convolutional Neural Network, Server Resources
- Modern Neural Network: Recurrent Neural Networks, Attention Mechanism & Transformer, Natural Language Processing, Reinforcement Learning, Generative Adversarial Networks
- Final project and Q&A: Chess board recognition system

## Configuration (pip)

- Python3.9 [[LINK](#)]
- Remember to add Python to PATH and environment variables
- Install required packages
  - `pip install -r ./0-introduction/requirements.txt`

- Please be aware of the dependencies if you have more than one Python installed
- VS Code [\[LINK\]](#) (optional)
  - Config Python3.9 in your vscode

```
$ python
Python 3.9.9 (tags/v3.9.9:ccb0e6a, Nov 15 2021, 18:08:50) [MSC v.1929 64 bit (AMD64)] on
win32
Type "help", "copyright", "credits" or "license" for more information.
>>> exit()
```

## Configuration (Miniconda)

- Miniconda installation package download [\[LINK\]](#)
- Open terminal in Vision2022/
  - Create a virtual environment and install required packages
  - `conda env create -f ./0-introduction/environment.yaml` (**GPU Only**, its environment name is vision2023)
  - Activate the virtual environment
  - `conda activate <environment name>`
- **Or** you can config in this way:
  - `conda create -n <environment name> python=3.9`
  - `conda activate <environment name>`
  - `pip install -r ./0-introduction/requirements.txt`

```
(vision2023) $ python
Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v.1916 64 bit (AMD64)] :: Anaconda, Inc.
on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> exit()
```

## Test configuration

- Run `python ./0-introduction/show_a_cat.py` under Vision2022/
  - Press Esc or q on the keyboard to close the window

```
import sys

print(sys.version)
```

3.9.12 (main, Jun 1 2022, 11:38:51)  
[GCC 7.5.0]

```
import cv2
import numpy as np
import matplotlib.colors as mat_color

print(cv2.__version__)

# Read the cat image
path = "./images/cat.jpg"
img_bgr = cv2.imread(path)

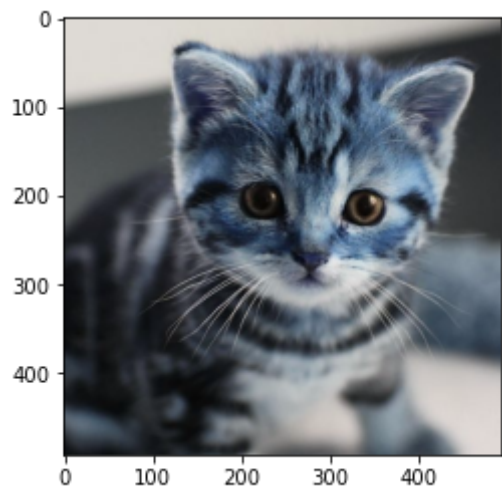
print(type(img_bgr))
print(np.shape(img_bgr))
```

4.7.0  
<class 'numpy.ndarray'>  
(493, 493, 3)

```
from matplotlib import pyplot as plt

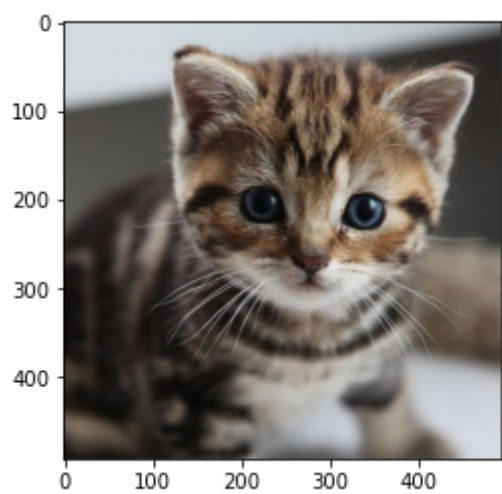
# display img
no_norm = mat_color.Normalize(vmin=0, vmax=255, clip=False)
plt.imshow(img_bgr, norm=no_norm)
```

<matplotlib.image.AxesImage at 0x7ff9561ede80>



```
# bgr -> rgb  
img_rgb = cv2.cvtColor(img_bgr, cv2.COLOR_BGR2RGB)  
plt.imshow(img_rgb, norm=no_norm)
```

```
<matplotlib.image.AxesImage at 0x7ff954150040>
```



```
import os

# save the img in csv format
os.makedirs('../data', exist_ok=True)
data_file = os.path.join('../data', 'cat.csv')
print(data_file)
with open(data_file, 'w') as f:
    f.write('R,G,B\n')
    for row in img_rgb:
        for rgb in row:
            f.write(str(rgb[0]) + ',' + str(rgb[1]) + ',' + str(rgb[2]) + '\n')
```

```
../data/cat.csv
```

The End